

A NEW SPECIES OF *Gobius* (TELEOSTEI: GOBIIDAE) FROM THE NORTHERN ADRIATIC SEA

by

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ABSTRACT. - *Gobius kolombatovici* sp. nov. is described from eleven specimens collected at the eastern coast of the Island of Krk, in the northern Adriatic Sea. The new species is assigned to *Gobius* on the basis of agreement with the diagnostic features of the genus, but differs from other species most obviously by the possession of a prominent dark spot on the rear part of the first dorsal fin. Meristic values for the new species are D2 I/13-14, A I/13, P 17-19 and LL 52-57. The species was found on the open substrates, at depths of 22-38 m.

RÉSUMÉ. - Une nouvelle espèce de *Gobius* (Teleostei: Gobiidae) de la mer Adriatique nord.

Gobius kolombatovici sp. nov. est décrit à partir de onze spécimens collectés près de la côte orientale de l'île de Krk, dans la partie nord de la mer Adriatique. Cette nouvelle espèce est rapportée au genre *Gobius* dont elle possède les caractères distinctifs, mais elle diffère des autres espèces du genre notamment parce qu'elle possède une tache sombre bien prononcée sur la partie arrière de la première nageoire dorsale. Les valeurs méristiques de la nouvelle espèce sont D2 I/13-14, A I/13, P 17-19 et LL 52-57. Cette espèce a été récoltée sur le substrat ouvert à 22-38 m de profondeur.

Key words. - Gobiidae - *Gobius kolombatovici* - MED - Adriatic Sea - New species - Systematics.

New gobiid species in the Mediterranean have been described in the last decades (Miller, 1966, 1968, 1982; Bath, 1971; Zander and Jelinek, 1976) and even in recent years (Miller, 1992; Ahnelt and Patzner, 1995). However, all of them are small-sized, and almost all cryptic fishes. The last larger gobies described in European waters were *Gobius* species from the eastern Atlantic coast (Miller, 1974; Miller and El-Tawil, 1974). During the investigations of eastern coast of the Island of Krk, in the northern Adriatic Sea, by one of us (MK), specimens of relatively large goby were collected on open substrates. The collected specimens represent a new species, described below.

METHODS AND ABBREVIATIONS

Morphometric and meristic methods as in Miller (1988). Fin abbreviations: A, anal fin; C, caudal fin; D1, D2, first and second dorsal fins; P, pectoral fin; V, pelvic disc. Morphometric abbreviations: Ab, anal fin base; Ad and Aw, body depth and width at anal fin origin; Cl, caudal fin length; CHd, cheek depth; CP and CPd, caudal peduncle length and depth; D1b and D2b, first and second dorsal fin base; E, eye diameter; H and Hw, head

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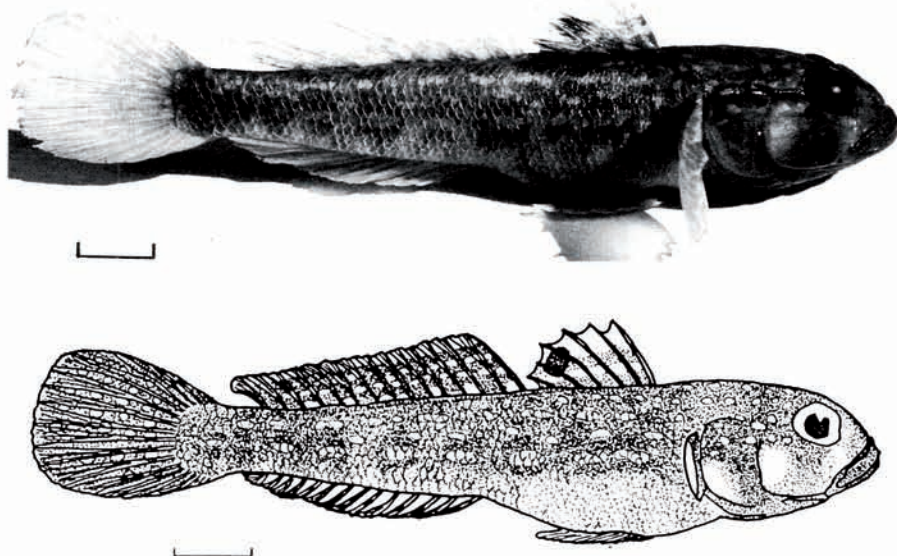


Fig. 1. - *Gobius kolombatovici* sp. nov., holotype, male, 91.9+21.2 mm, PMR VP242. Scale = 10 mm.

Fig. 2. - *Gobius kolombatovici* sp. nov., holotype, male, 91.9+21.2 mm, PMR VP242, in lateral view. Scale = 10 mm.

length and width; I, interorbital width; Pl, pectoral fin length; PO, postorbital length; SL, standard length; SN, snout length; SN/A and SN/AN, distance from snout to vertical of anal fin origin and anus; SN/D1 and SN/D2, distance from snout to origin of first and second dorsal fins; SN/V, distance from snout to vertical of pelvic fin origin; V/AN, distance from pelvic fin origin to anus; Vd, body depth at pelvic fin origin; VI, pelvic fin length. Terminology of lateral-line system follows Sanzo (1911) and Miller (1986). The benthic communities were classified according to Pérès and Gamulin-Brida (1973).

***GOBIUS KOLOMBATOVICI* SP. NOV.**

(Figs 1, 2, Table I)

Material

Holotype. - Male, 91.9+21.2 mm, PMR VP642, Croatia, Kamenjak, the Island of Krk, Sept. 18, 1998, leg. M. Kovačić.

Paratypes. - Two females, 76.0+16.0 mm, PMR VP635, and 90.6+18.4 mm, Croatia, Plovanov stol, the Island of Krk, Jun. 10, 1998, leg. M. Kovačić; female, 66.5+12.0 mm, PMR VP636, and two males, 83.0+17.2, 59.5+11.8 mm, PMR VP637, Croatia, Plovanov stol, the Island of Krk, Sep. 11, 1998, leg. M. Kovačić; female, 68.3+13.9 mm, PMR VP638, two males, 72.3+15.2, 60.7 + 11.8 mm, PMR VP639, juvenile, 31.9+5.9 mm, PMR VP640, Croatia, cape Tenki, the Island of Krk, Sep. 24, 1998, leg. M. Kovačić; male, 63.1+13.3 mm, PMR VP641, Croatia, cape Sv. Marak, the Island of Krk, Oct. 23, 1998, leg. M. Kovačić.

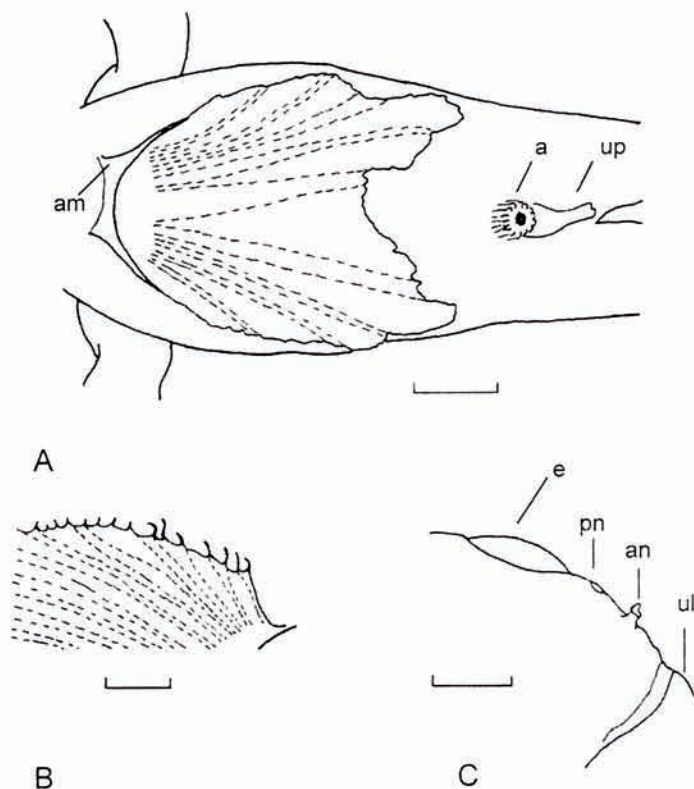


Fig. 3. - *Gobius kolombatovici* sp. nov., holotype, male, 91.9+21.2 mm, PMR VP242. **A:** pelvic disc emarginate with reduced anterior pelvic membrane; **B:** pectoral fin with uppermost rays free from membrane; **C:** snout with anterior and posterior nostrils. Abbreviations: anterior nostril (an), posterior nostril (pn), eye (e), upper lip (ul), anterior pelvic membrane (am), anus (a), urogenital papilla (up). Scale = 5 mm (A), 3 mm (B), 4 mm (C).

The holotype and paratypes are deposited at the Prirodoslovni muzej Rijeka (PMR), except for the paratype 90.6+18.4 mm, Croatia, Plovanov stol, the Island of Krk, June 10, 1998, which was donated to the British Museum of Natural History (BMNH).

Generic identification

This species is placed in *Gobius* Linnaeus, 1758 (type species: *G. niger* Linnaeus, 1758), as defined by Miller and El-Tawil (1974), by its possession of (1) anterior and posterior oculoscapular, and preopercular, head lateral-line canals, with pores σ , λ , κ , ω , α , β , ρ , ρ' , ρ'' , and γ , δ , ϵ respectively; (2) six transverse suborbital rows (1-6) of sensory papillae, with inferior sections of rows 5 and 6 well developed; (3) row *g* ending behind row *o*; (4) snout five median preorbital series, row *r* divisible into two sections; (5) P with uppermost rays branched and more or less free from fin-membrane; (6) anterior nostril with dermal process from posterior rim; and (7) predorsal and postorbital regions with scales. *Gobius kolombatovici* differs from Miller and El-Tawil's (1974)

definition of the genus only in having anterior dorsal row *o* continuous or overlapped with its fellow in dorsal midline in the majority of specimens. This definition may now be amended in (8) anterior dorsal row *o* well separated from fellow in dorsal midline, except for *G. kolombatovici* and *G. cruentatus* (Miller, 1986) where rows *o* approach closely or meet in midline.

Species identification

G. kolombatovici is easily distinguishable from the other fifteen north-eastern Atlantic and Mediterranean *Gobius* species (including *G. strictus*, a species of a doubtful status) by (1) row *g* reaching lateral end of row *o* (except for *G. fallax*), (2) row *o* variably related to fellow in dorsal midline, usually connected or overlapping, but sometimes separate (except from *G. cruentatus*), (3) body and head with orange spots and blotches, body spots and blotches clearly visible even in preserved specimens, after loss of orange colouration, and (4) D1 with black blotch in upper posterior corner (on D1 IV and

Table I. - Body proportions of *Gobius kolombatovici* sp. nov. Values for females and males are range, and, in, parentheses, mean and standard deviation, values of juvenile are individual. For abbreviations, see text, methods.

Sex	Males	Females	Juvenile
n	6	4	1
SL (mm)	59.5-91.9	66.5-90.6	31.9
%SL, H	29.2-32.0 (30.7 ± 1.2)	28.9-31.1 (30 ± 1.2)	32.9
Hw	19.4-23.1 (21.2 ± 1.4)	18.9-21.7 (20.2 ± 1.3)	19.1
SN/D1	32.9-35.6 (34.4 ± 1.1)	32.6-37.0 (34.3 ± 2.0)	37.0
SN/D2	48.4-53.3 (51.6 ± 1.7)	50-53.6 (51.7 ± 1.5)	51.7
SN/AN	50.2-57.7 (53.5 ± 2.4)	50.8-57.7 (53.9 ± 3.1)	54.2
SN/A	53.4-59.3 (56.5 ± 2.0)	54.7-57.5 (56.2 ± 1.2)	58.0
SN/V	28.5-33.0 (30.7 ± 1.5)	28.0-33.8 (29.7 ± 2.8)	31.0
CP	17.5-21.1 (20.0 ± 1.3)	19.4-21.2 (20.5 ± 0.8)	19.7
D1b	14.7-17.8 (16.1 ± 1.3)	14.6-17.3 (16.2 ± 1.2)	15.7
D2b	29.0-32.3 (30 ± 1.3)	30.0-33.3 (32.4 ± 1.6)	29.2
Ab	21.9-25.2 (23.5 ± 1.2)	21.4-24.8 (23.3 ± 1.5)	22.3
Cl	19.4-23.1 (20.9 ± 1.3)	18.0-21.1 (19.9 ± 1.3)	18.5
Pl	21.3-23.9 (22.6 ± 1.1)	21.5-24.0 (22.5 ± 1.1)	21.3
VI	20.5-23.7 (22.1 ± 1.3)	21.1-23.4 (22.1 ± 1.1)	21.3
Vd	17.9-20.0 (19.1 ± 1.0)	20.0-20.9 (20.3 ± 0.4)	19.7
Ad	14.7-16.7 (16.0 ± 0.7)	15.7-17.8 (16.7 ± 0.9)	15.4
Aw	9.9-14.0 (11.6 ± 1.6)	11.9-14.7 (13.2 ± 1.5)	10.0
CPd	9.6-10.5 (10.1 ± 0.4)	10.1-10.6 (10.3 ± 0.2)	11.9
V/AN	21.4-24.7 (22.9 ± 1.2)	22.6-26.7 (24.2 ± 1.8)	23.2
%CP, CPd	39.4-58.8 (48.2 ± 7.0)	48.6-54.9 (51.3 ± 2.7)	60.3
%H, SN	24.7-28.6 (26.9 ± 1.5)	21.8-27.5 (25.7 ± 2.6)	28.6
E	22.5-25.1 (23.8 ± 1.1)	22.7-27.7 (24.9 ± 2.2)	26.7
PO	47.5-52.2 (49.5 ± 1.6)	47.7-50.7 (49.4 ± 1.4)	44.8
CHd	18.2-23.6 (21.5 ± 2.0)	17.1-23.2 (20.6 ± 2.7)	19.0
Hw	64.9-79.1 (69.3 ± 5.3)	62.6-75 (67.2 ± 5.6)	58.1
%E, I	21.2-31.8 (25.3 ± 3.9)	19.7-29.7 (24.5 ± 5.4)	17.2
%V/AN, VI	82.9-110.4 (96.8 ± 9.7)	84.7-98.8 (91.3 ± 6.1)	91.9

D1 V), remaining also in preserved specimens. Although resembling *G. cruentatus* in rows *o* meeting in midline and the emarginate pelvic disc, the present new species further differs from *G. cruentatus* in (1) absence of cheek scales, and (2) shorter row *x*, not reaching pore β anteriorly. Among *Gobius* species, the new species seems to be close to *G. fallax*, *G. xanthocephalus* and *G. auratus*, sharing with them several important characters: (1) rows 2 and 3 begin near orbit (except *G. auratus*); (2) pelvic disc emarginate (Fig. 3A); (3) pelvic anterior transverse membrane reduced; (4) P free rays only moderately developed (Fig. 3B); (5) anterior nostril with triangular lappet (Fig. 3C); (6) mark on upper P fin origin; and (7) markings arranged in longitudinal striae along the body (except *G. auratus*). *G. kolombatovici* differs from these species also by a higher number of scales in lateral series (> 50).

Name

In honour of Juraj Kolombatović (1843-1908), professor of mathematics at Split, one of the most important Croatian taxonomists, and the only Croatian naturalist to have worked intensively on small inshore fishes (Blenniidae, Gobiidae, Tripterygiidae).

General description

See Generic and Specific Identification. Body proportions are given in table I. Body moderately elongate, laterally compressed at caudal peduncle, head depressed. Head large (Table I); snout oblique, usually longer than eye; anterior nostril short, tubular, with triangular process from inner part of rim (Fig. 3C). Eyes relatively small (Table I), compared to other, smaller *Gobius* species; eyes dorsolateral, with narrow interorbital space. Mouth oblique, jaws subequal, posterior angle of jaws below anterior half of pupil. Branchiostegal membrane attached along entire lateral margin of isthmus from immediately anterior to pectoral margin. Tongue truncate; teeth in jaws erect, caniniform, in several rows; teeth in the first row larger; pharyngeal teeth caniniform.

Fins

D1 VI; D2 I/14 (14:10, 13:1); A I/13; C 17 articulated rays, 14 branched (14:10; 15:1); P 17-19 (17:2; 18:8; 19:1), V I/5+5/I. Fin-bases and lengths in proportion to standard body length given in table I. D1 rays not elongate. P with ends of three uppermost rays free from membrane, tips of remaining pectoral rays forming crenate periphery of fin (Fig. 3B). V emarginate 3/5-4/5 of length (the shortest branches of V5 compared to the longest branches of V4: 58.1-79.1%; 68.3 ± 6.0); anterior membrane reduced (Fig. 3A). C rounded.

Scales

Body covered with ctenoid scales. Predorsal area, including nape, and breast scaled; ctenoid scales on predorsal area small, about 20 in midline. Opercle naked or with a few to about twenty scales. Cheek naked. Scales in lateral series 52-57 (11 specimens, left and right side: 52:2, 53:2, 54:8, 55:6, 56:3, 57:1), in transverse series 14-16 (11 specimens, left and right side: 14:8, 15:10, 16:4).

Coloration

In life (from photographs in the habitat). Body pale to fawn, with light orange irregular spots arranged in longitudinal rows, underside whitish to pale. Nine dark orange blotches along lateral midline, longer than deep, include two below D1, five below D2,

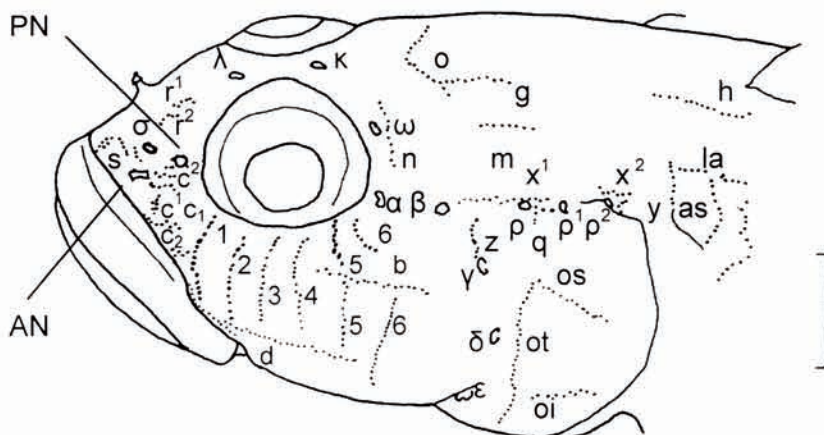


Fig. 4. - *Gobius kolombatovici* sp. nov. Head lateral-line sensory papillae and canal pores of holotype, male. AN, PN, anterior and posterior nostrils; see other terminology in text. Scale = 5 mm.

and two on caudal peduncle. One row of longitudinal light orange irregular spots below lateral midline blotches, two rows of spots above lateral midline blotches extend on predorsal area and nape. Another longitudinal row of spots on predorsal area and nape above previous two, beginning at D1 origin. The lowest row of predorsal spots continues as brown band over the eye. Head similar to body, pale to fawn, with ventral side whitish to pale. Light orange to yellow irregular spots on upper border of eyes, interorbital space, snout, cheek and opercle not in irregular rows. Median fins and P transparent, except for spots and blotches. V less transparent, whitish. D1 and D2 with four horizontal rows of light orange to yellow spots. D1 with black blotch in upper posterior corner (on D1 IV and D1 V), except in juvenile (PMR VP640). C with five to six vertical rows of light orange to yellow spots. A with only one horizontal row of light orange to yellow spots, near finbase. P with orange mark in upper fin origin.

Preserved specimens. Coloration of freshly collected and freshly preserved specimens differs from that of living specimens in the dominant colour of lateral and dorsal sides turning from fawn to greyish brown. The orange colour of blotches and spots is lost in the weeks following fixation, so final body colour of preserved specimens is lateral and dorsal sides greyish brown with pale to dusky blotches and spots, underside pale, fins dusky, unpaired fins with pale spots, and D1 with black blotch in upper posterior corner. No distinct sexual dimorphism is evident on collected specimens.

Vertebrae

Number of vertebrae 28 (counted on X-ray photographs: 28:3), including urostyle.

Lateral line system (Fig. 4)

Head with anterior and posterior oculoscapular, and preopercular canals, with pores σ , λ , κ , ω , α , β , ρ , ρ^1 , ρ^2 , and γ , δ , ϵ respectively; anterior oculoscapular canal with pore α at the rear of orbit. Rows and number of sensory papillae (counted on 11 specimens) as follows:

(1) *preorbital*. - Snout with five median preorbital series, row r divisible into two sections, superior inner r^1 (3-7) and inferior outer r^2 (3-7), row s^1 (2-6) below pore σ , s^2 (3-7) and s^3 (5-10) more medially. Lateral series c in three parts: superior (c^1) in two rows, upper (1-6) and lower (3-9); middle (c^1) with upper horizontal (3-8) and lower vertical sections (2-11); inferior upper c_1 (6-10) and lower c_2 (3-6).

(2) *suborbital*. - Six transverse suborbital rows (1-6) of sensory papillae, rows 2 and 3 begin near orbit, inferior sections of rows 5 and 6 well developed, inferior segment of row 5 ending nearly above row d , inferior segment of row 6 not greatly extended below level of row d (1: 9-18, 2: 7-16, 3: 8-18, 4: 9-19, 5s: 5-11, 5i: 4-12, 6s: 5-13, 6i: 8-17). Longitudinal row b (11-21) extending forwards through row 5. Longitudinal row d (22-44) continuous, in the majority of specimens supralabial and horizontal part not joined, but overlapped.

(3) *preoperculo-mandibular*. - External row e and internal row i divided into anterior (e : 22-41, i : 11-28), and posterior sections (e : 21-36, i : 13-28); row f (6-12).

(4) *oculoscapular*. - Anterior longitudinal row x^1 (11-18) from behind pore β to pore ρ^1 , posterior longitudinal row x^2 (4-10) above ρ^2 ; row z (5-11) with lower end at pore γ , row q (4-8) between pores ρ and ρ^1 , row y (2-7) behind pore r^2 . Axillary rows as^1 (7-13), as^2 (6-10), as^3 (7-16), la^1 (2-6), la^2 (3-6) well developed.

(5) *opercular*. - Transverse row ot (19-39); superior longitudinal row os (8-18); and interior longitudinal row oi (6-12).

(6) *anterior dorsal*. - Anterior transverse row n (7-14) behind pore ω ; row g (7-11) reaches lateral part of row o , row o (6-11) variably related to fellow in dorsal midline, connected, overlapping or separate, row m (5-10), row h (8-19).

(7) *trunk and caudal*. - Transverse dorsal trunk row ld (10-14), flanking D1 IV; median trunk series ltm of 25-30 transverse rows along lateral midline to C origin, anterior rows longer (near P origin 16-20) and posterior shorter (near C origin 8-11); ventral trunk series lv of three vertical rows (17-23, 13-21, 10-16) spaced from V origin to anus. Three caudal rows.

Geographical distribution

Gobius kolombatovici has been found at four closely situated localities: Plovanov stol, Kamenjak, Cape Tenki, and Cape Sv. Marak at the eastern coast of the Island of Krk, Croatia, in the northern Adriatic Sea.

Ecology

Gobius kolombatovici is a bottom-dwelling and secretive species. Specimens were observed at depths of 15 to 38 m. Depth distribution differs between locations investigated (15-30 m, 20-33 m, 22 m, 29-38 m) and depends on the presence of suitable habitat. The species was found to inhabit localities with a combination of soft sediment and rock, usually at the foot of rock walls, and among nearby boulders and rocks, or on the moderately sloping bedrock with expanses of soft bottom. The soft sediment of these habitats usually consists of detritic coarse sand and fine gravel (shell-gravel), often slightly enriched with silt. The rock surface is covered by calcareous algae (*Peysonnelia* spp., *Pseudolithophyllum expansum*), mixed with other scyaphilic algae (*Codium adhaerens*, *Halimeda tuna*, *Udotea petiolata*) of the precoralligenous facies of the coralligenous biocoenosis. Many sessile invertebrates on these places are typical of the precoralligenous facies of the coralligenous biocoenosis (*Eunicella cavolinii*, *E. singularis*, *Petrosia ficiiformis*), or, in more shaded situations, for the biocoenosis of shaded and semi-dark

niches (*Axinella canabina*, *Leptosammia prouvoti*, *Myriapora truncata*, *Parazoanthus axinellae*, *Porella cervicornis*, *Verongia cavernicola*). The fauna and flora are scattered barely over shell gravel bottom, except for rare cover of *Vidalia volubilis*. *G. kolombatovici* has not been observed above the zone described, on the bottoms mostly covered with photophilic algae, and at deeper depths, on uniform detritus.

Common fish species, in the same habitat as *G. kolombatovici*, are epibenthic *Gobius vittatus*, *Parablennius rouxi*, *Thorogobius macrolepis* and hyperbenthic *Coris julis*, *Chromis chromis*, *Serranus hepatus*. Especially interesting is the regular presence (in 73% of positions with *G. kolombatovici*) of similarly coloured, smaller *Thorogobius macrolepis*, which also resembles *G. kolombatovici* in emargination of the pelvic disc, perhaps convergent in relation to life on a soft substrate where any suction advantage of this structure would not be significant. However, the former species otherwise differs markedly from *G. kolombatovici* in pattern of head sensory papillae, lack of free pectoral rays, and most meristics (Ahnel and Kovačić, 1997; Miller, 1986). Other fishes, occasionally recorded with *G. kolombatovici*, were the epibenthic *G. cruentatus*, *G. roulei*, yellow *Gobius* (*G. fallax* or *G. xanthocephalus*) and hyperbenthic *Acantholabrus palloni*, *Diplodus vulgaris*, *Oblada melanura*, *Serranus cabrilla*, *Symphodus mediterraneus*, *Symphodus ocellatus*.

The specimens of *G. kolombatovici* were usually seen laying on a soft substrate never more than a few dozen centimetres from shelter (crevices, small caves, space below boulders and rocks on soft sediment) or just at the shelter entrance. During SCUBA diving the specimens were seen mostly alone, usually one every 1 or 2 m along the base of a vertical rock face. Similarly abundance was observed on soft sediment among boulders and rocks close to the rock face. They were present less frequently on the soft bottom areas on less sloping bedrock. *G. kolombatovici* is a timid species, compared to other *Gobius* species, and rarely allows SCUBA diver to approach close to it.

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